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4.2 CONCRETE CURBS, GUTTERS, SIDEWALKS, MEDIANS, AND TRAFFIC ISLANDS**4.2.1 GENERAL**

The work shall include construction of the following items:

- (a) Curbs, gutters and combination curb and gutter sections,
- (b) Curbs for medians and traffic islands which have concrete, asphalt or topsoil surfacing,
- (c) Solid concrete medians, traffic islands and sign islands,
- (d) Separate sidewalks,
- (e) Monolithic sidewalk curb and gutter sections,
- (f) Concrete swales,
- (g) Outlet gutters, and
- (h) Concrete barriers.

These cast in place, extruded or precast structures shall consist of air entrained portland cement concrete with or without reinforcing steel, prepared in accordance with the specifications and to the lines, grades and typical cross-sections as shown on the plans or as designated by the Consultant.

Curbs shall include mountable, semi-mountable and barrier types.

4.2.2 MATERIALS**4.2.2.1 General**

The Contractor shall supply all materials, including forms for the construction of the work.

4.2.2.2 Aggregate

The Contractor shall produce aggregate materials in accordance with Specification 3.2, Aggregate Production and Stockpiling. Gravel or sand bedding material shall be select and shall consist of well graded sand or a well graded mixture of natural sand, gravel and/or crushed rock, all of which shall pass a 40 mm sieve opening. Any processing required to meet this gradation requirement shall be the responsibility of the Contractor. The Contractor shall supply aggregate in accordance with Specification 5.2, Supply of Aggregate and haul aggregate in accordance with Specification 4.5, Hauling.

4.2.2.3 Portland Cement Concrete

Portland cement concrete shall comply with the requirements of Specification 5.5, Portland Cement Concrete for concrete class B except that the minimum air content shall be 6% unless otherwise directed by the Consultant, and except that for precast F type barrier curbs the compressive strength of the concrete at 28 days shall be 40 MPa.

4.2.2.4 Expansion Joint Fillers

Preformed expansion joint fillers shall conform to the requirements in the most recent edition of A.S.T.M. Designation D1751 and shall be of adequate dimensions to fill the joint fully and continuously throughout its entire depth.

4.2.2.5 Curing and Sealing Compounds

Curing compound shall conform to the most recent edition of A.S.T.M. Designation C309 and shall contain white fugitive dye.

Sealing compound shall be a mixture of 50% kerosene and 50% boiled linseed oil.

4.2.2.6 Reinforcing Bars and Wires

Steel reinforcing bars shall be deformed bars in accordance with the most recent edition of CSA G30.12 - M "Billet Steel Bars for Concrete Reinforcement". For F type barrier curbs the bars shall also be epoxy coated.

Cold drawn wire or welded wire fabric for concrete reinforcement shall conform to the requirements of the latest edition of CSA G30.5.

4.2.2.7 Median Fill Materials

Fill material for medians to be surfaced with portland cement concrete or Asphalt Concrete shall be crushed aggregate of the Designation and Class specified. The Contractor shall process the material by crushing if required to meet the specifications.

Fill material for medians to be topsoiled shall be clayey soil free of stones, clods, sticks, roots, concrete and other debris.

Asphalt concrete for median surfacing shall be supplied, produced and placed in accordance with the requirements of Specification 3.50, Asphalt Concrete Pavement-EPS. Unless otherwise specified in the special provisions, the Mix Type shall be as used elsewhere on the project. Gradation of the median surfacing asphalt concrete aggregate shall be in accordance with the requirements for the Designation and Class specified or directed by the Consultant.

Topsoil for medians shall meet the requirements of Specification 2.6, Topsoil Placement.

4.2.3 SAMPLING AND TESTING**4.2.3.1 General**

The Consultant will take samples, carry out testing and inspection of materials incorporated or being incorporated into the work. The Contractor shall cooperate with the Consultant during the sampling, testing and inspection. Such inspection shall not relieve the Contractor from any obligation to perform all the work strictly in accordance with the requirements of the Contract.

Locations for routine quality testing shall be randomly selected as far as it is practical to do so. This will not limit the Consultant from testing at any additional locations as he deems necessary.

Results of the tests will be made available to the Contractor for his information. The Contractor shall be responsible for interpretation of test results and alter his operation if necessary, so that the product meets the specifications.

4.2.3.1.1 Test Methods

Unless otherwise specified, the most recent editions of the following standard test methods will be used to determine the material characteristics.

Test Description	Method No.
Slump	CAN3-A23.2-5C
Entrained Air	CAN3-A23.2-7C
Compressive Strength	CAN3-A23.2-9C

For each compressive strength test a slump test will also be made and the amount of entrained air will be measured.

4.2.4 CONSTRUCTION

4.2.4.1 **General**

The Contractor shall be responsible for the proper adjustment and calibration of his equipment.

4.2.4.2 **Preparation of Base and Bedding**

Soft, yielding or unsuitable base material shall be removed and disposed of, as directed by the Consultant, and replaced with approved material. The base material shall be thoroughly compacted to 95% of Standard Proctor Density at optimum moisture to a depth of 150 mm and finished to a smooth, uniform surface, true to established line and grade. Base preparation shall extend sufficiently beyond the edges of the structure to enable forming and construction of the work.

The Contractor shall place and compact a gravel or sand bedding course upon the prepared base to a minimum compacted depth of 50 mm, or as otherwise specified or directed by the Consultant. Gravel or sand bedding shall be placed to the widths as specified or as directed by the Consultant, and shall be thoroughly compacted to a smooth, uniform surface, true to established lines and grade. Bedding material shall extend sufficiently beyond the edges of the structure to enable support, forming and construction of the work.

4.2.4.3 **Adjusting Catch Basins and Manholes**

Raising or lowering catch basin or manhole frames, where adjustment of 100 mm or less is required in order to meet sidewalk or curb and gutter grades shall be accomplished by means of bricks and mortar or precast risers and mortar or cast iron extension rings as directed by the Consultant.

Raising or lowering catch basin or manhole frames where adjustment of more than 100 mm is required in order to meet the sidewalk or curb and gutter grade will require adjustment of the manhole or catch basin barrel in conjunction with adjustment of the frame and cover as described above.

4.2.4.4 **Forms**

Steel or wood forms shall conform to the shape, lines and dimensions of the concrete shown on the plans. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free from

loose knots or other defects. Forms shall extend the full depth of the section being formed, and shall be secure and sufficiently tight to prevent leakage of mortar. Forms shall be properly braced or tied together to maintain position and shape, and shall be thoroughly cleaned and coated with a non-staining form-release oil, before concrete is placed therein. Forms shall not be disturbed until the concrete has hardened sufficiently to prevent damage.

Where form ties are used they shall be cut off inside the surface of the concrete and the holes shall be patched.

4.2.4.5 Extrusion

Where slip-form paving machines or concrete extruding machines are used for placing concrete, they shall meet the following requirements:

- (a) The machines shall be approved by the Consultant prior to commencement of the work.
- (b) The vibrators on the equipment shall be adequate to produce a dense mass free of voids with a smooth surface free of honeycombing.
- (c) The equipment shall have automatic grade and line control.
- (d) The equipment shall, in a single pass, provide the specified shape and cross-section for the concrete items to be constructed.

4.2.4.6 Steel Reinforcement

Steel reinforcement, dowels or tie bars, when specified, shall be properly spaced, aligned, and held in correct position during the placement of the concrete by the use of bar chairs or other approved devices. Longitudinal bars shall extend through all contraction joints, and shall terminate a minimum of 50 mm from any expansion or construction joint. Bars shall overlap at splices by at least 300 mm.

4.2.4.7 Wire Mesh Reinforcement

Wire mesh reinforcement, when specified, shall be properly placed and held in position during the placement of the concrete by use of chairs or other approved devices. Joints in the wire mesh shall be overlapped 100 mm. Wire mesh reinforcement shall terminate a minimum of 50 mm from any expansion or construction joint.

4.2.4.8 Placing Concrete

The bedding shall be in a moist condition immediately prior to the time the concrete is placed. The concrete shall be spread uniformly to the required cross-section, without segregation, and thoroughly consolidated to eliminate excess air voids and to bring sufficient mortar to the surface for proper finishing. Before final finishing, surfaces shall be tested with a 3 m straightedge, and any irregularities of more than 6 mm in 3 m shall be corrected.

Concrete placement between construction joints shall be continuous. Where there is a delay of more than 30 minutes in the placement of concrete a construction joint shall be formed.

Concrete shall not be placed during rain or during other adverse weather conditions.

Concrete shall not be placed on frozen base or frozen bedding.

4.2.4.9 Crossings

Lane, commercial and private crossings shall be constructed on prepared bases at locations and to the depths and widths as indicated on the drawings and as directed by the Consultant. When specified, crossings shall be reinforced with steel wire mesh.

4.2.4.10 Precast Sections

Precast sections shall be placed on a prepared base, to the line and grade specified, as shown on the plans or as directed by the Consultant.

4.2.4.11 Joints

4.2.4.11.1 General

Joints shall be perpendicular to the subgrade and at right angles to the longitudinal axis of the structure. Joints shall be formed and edged with a 6 mm radius so as to leave a neat finished appearance.

4.2.4.11.2 Contraction Joints

For curbs, combination curb and gutter sections, separate sidewalks, and monolithic sidewalk, curb and gutter sections, contraction joints shall be formed every 3 m except where shorter spacing is necessary for closures, but no section shall be less than 1 m in length. Contraction joints shall be made by the use of one of the following methods:

- (i) Sawing a joint 50 mm deep with a concrete saw early enough after the concrete has set to prevent uncontrolled cracking, but not so soon as to displace the aggregate from the edges of the cut. The timing of sawing shall be the Contractor's responsibility.
- (ii) Forming a joint 50 mm deep by inserting into the plastic concrete a metal or fibre strip or a polyethylene film, finishing the edges to a 6 mm radius, and removing the insert as soon as initial set of the concrete has taken place.
- (iii) Forming a joint 50 mm deep with a jointing tool with a thin metal blade to impress a permanent plane of weakness into the plastic concrete.

For sidewalk construction a surface joint 15 mm in depth shall be constructed alternating with and halfway between contraction joints. This joint shall not extend into the curb and gutter section.

An additional surface joint 15 mm in depth shall be constructed longitudinally in monolithic curb, gutter and sidewalk for the purposes of delineating the back of the curb. This joint shall be located at the distance from the back of sidewalk as indicated on the drawings and shall be continuous for the entire length of the structure including driveway and lane crossings.

4.2.4.11.3 Expansion Joints

Expansion joints shall be constructed with a preformed expansion joint filler to the full depth of the concrete at the following locations:

- (i) where the concrete structure abuts a building, pole or other permanent structure;
- (ii) at construction joints;
- (iii) where shown on the drawings; and
- (iv) where directed by the Consultant.

4.2.4.11.4 Construction Joints

Construction joints shall be formed using steel divider plates, at specified locations, or as otherwise designated by the Consultant. Should concrete placing operations be unavoidably interrupted, construction joints shall be formed at the last fully completed panel.

Construction joint divider plates shall be left in place until the concrete has set sufficiently to hold its shape, and shall be removed without damaging the concrete.

Steel dowels, greased on one end, shall be incorporated into construction joints where specified or as directed by the Consultant.

4.2.4.12 **Finishing**

Exposed concrete surfaces shall have a brush finish. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter.

Exposed edges on sidewalks including contraction and surface joints, shall be tooled for a width of 50 mm and rounded to a radius of 6 mm, or as otherwise specified.

The finished concrete shall be true to cross-section, line and grade, and the surface shall be tight, smooth and free of honeycombing and irregularities. Concrete with honeycombing or other irregularities shall be removed and replaced as directed by the Consultant.

4.2.4.13 **Identification of Work**

Identification marks showing the name of the Contractor and the year constructed, shall be placed at the end of each block or at the terminal points of the work in each block, in a neat, easily legible form, as approved by the Consultant.

4.2.4.14 **Curing, Sealing and Protection**4.2.4.14.1 Curing

Immediately after finishing, the concrete shall be protected against moisture loss by the application of an approved curing compound.

Curing compounds shall be applied by spraying with pressure equipment. To ensure complete coverage, approximately one-half the quantity for a given area shall be applied in one direction and the remainder applied at right angles to this direction.

Curing compounds shall not be used on a surface where a bond is required with additional concrete to be placed later.

4.2.4.14.2 Sealing

The concrete shall be dry and swept clean prior to application of sealing solution as directed by the Consultant.

To protect the surface from deterioration by de-icing salt the sealing solution shall be applied by spraying with pressure equipment on all exposed surfaces. The first application of the sealing solution shall be made five to seven days after placing the concrete and shall have a coverage of not less than 0.1 P/m² and the second application shall be made immediately after the first has been absorbed and the concrete regains its first dry appearance. This application shall have a coverage rate of not less than 0.08 P/m². To ensure complete coverage, approximately one-half the quantity for each application on a given area shall be applied in one direction and the remainder applied at right angles to this direction.

4.2.4.14.3 Protection

Concrete shall be protected against damage from rain, dust, rapid temperature change or other adverse weather effects. For at least 7 days after finishing, concrete shall be protected against freezing and against damage by any form of traffic. With the approval of the Consultant, the Contractor may block off areas containing fresh concrete to safeguard the work from traffic.

Methods and materials used for protecting concrete from damage shall be entirely the responsibility of the Contractor, and shall be subject to prior approval of the Consultant.

Concrete damaged by moisture loss, freezing, rain, traffic, construction operations, or any other cause, shall be repaired, or removed and replaced, to the satisfaction of the Consultant, at the Contractor's expense.

4.2.4.15 **Backfill**

For outlet gutters, sidewalks and monolithic curb, gutter and sidewalks, the Contractor shall backfill as soon as possible after the removal of forms. The backfill shall be mechanically tamped and trimmed.

For curb and gutter the Contractor shall backfill behind the curb with suitable material after the seven day curing and protection period has elapsed. The backfill shall extend to at least 600 mm behind the curb and shall be compacted in two lifts. The densities shall be obtained by means of a hand operated mechanical tamper or other equipment as approved by the Consultant.

Organic soils shall not be permitted for backfilling, except where topsoil is specified for the top 100 mm of fill.

4.2.4.16 **Fill for Medians, Sign Islands and Traffic Islands**4.2.4.16.1 Topsoiled Medians

Fill for medians to be topsoiled shall be placed and moderately compacted to a smooth surface 150 mm below the top of the median curb. The material shall be classified in accordance with Specification 2.3, Grading.

4.2.4.16.2 Other Medians

Fill for medians to be asphalt concrete surfaced or concrete surfaced shall be crushed aggregate placed and compacted as shown on the drawings, and as directed by the Consultant.

4.2.4.17 **Median Surfacing**4.2.4.17.1 Topsoil Surfacing

Topsoil surfacing of medians shall be placed in accordance with Specification 2.6, Topsoiling.

4.2.4.17.2 Asphalt Concrete Surfacing

Asphalt concrete material for median surfacing shall be supplied and placed in accordance with Specification 3.50, Asphalt Concrete Pavement-EPS except that the density requirements will not apply. The finished surface shall be true to cross-section and grade, shall be compacted and shall have a smooth, tight, uniform surface.

4.2.4.17.3 Concrete Surfacing

Concrete material for median surfacing shall be supplied in accordance with the requirements of Specification 5.5, Portland Cement Concrete and placed, finished, cured and sealed in accordance with the appropriate sections of this specification.

4.2.5 REQUIREMENTS FOR ACCEPTANCE

Completed concrete work will not be accepted unless the following requirements have been met:

- (a) 90% of all compressive strength tests shall have values in excess of the specified concrete strength.
- (b) The average of any five consecutive tests shall be equal to or greater than the specified strength.
- (c) No three consecutive tests shall fall below the specified strength.

When the concrete strength requirements are not met, the construction represented by the low tests is not acceptable and shall be removed and replaced. Removing and replacing of rejected concrete construction shall be done at the Contractor's expense.

Any work found to be defective or damaged by weather, traffic or other causes, shall be repaired or removed and replaced, as directed by the Consultant, at the Contractor's expense.

4.2.6 MEASUREMENT AND PAYMENT4.2.6.1 **General**

The quantities, determined as specified, will be paid for at the contract unit prices which shall be compensation in full for base preparation and the furnishing of materials, labour, equipment, tools, and incidentals necessary to complete the work in accordance with the plans and specifications.

4.2.6.2 **Excavation, Base Preparation, and Gravel or Sand Bedding**

Where the excavation and base preparation is done as part of road construction, which is part of the Work, payment for the excavation and base preparation will be made in accordance with the appropriate unit prices bid for this Work. Otherwise, excavation, base preparation and bedding will not be measured and paid for separately but will be included in the contract unit price for the concrete structure.

4.2.6.3 **Adjusting Catch Basins and Manholes**

Payment for adjusting catch basin and manhole frames and covers will be made at the unit price bid per catch basin or manhole. Payment for adjustment of catch basin and manhole barrels will be made as Extra Work in accordance with Specification 1.2, General.

4.2.6.4 **Concrete Structures**4.2.6.4.1 Solid Concrete Medians and Islands

Solid concrete medians and solid concrete islands will be measured in square metres of completed top surface area and payment will be made at the applicable unit price bid per square metre for "Solid Concrete Medians" or "Solid Concrete Islands." These payments will be full compensation for supplying and installing any curbing or curb and gutter forming part of the solid concrete median or island.

4.2.6.4.2 Curbs, Gutters, Combination Curb and Gutter Sections, Sidewalks, Monolithic Sidewalk Curb and Gutter Sections, Concrete Barriers, and Swales or combinations thereof

Measurement will be made in linear metres to the nearest 0.1 metre and payment will be made at the applicable unit price bid for:

- (i) "Concrete Curb", measured along the length of the curb, with separate payment for each type of curb.
- (ii) "Gutters", and "Outlet Gutter", measured along the length of the gutter.
- (iii) "Curb and Gutter", measured along the length of the curb face.
- (iv) "Concrete Sidewalk", measured along the length, with separate payment for each specified width.
- (v) "Monolithic sidewalk, Curb and Gutter", measured along the length, with separate payment for each specified width.
- (vi) "Concrete Swale", measured along the flow line.

(vii) "Concrete Barrier", measured along the length.

4.2.6.4.3 Rip-Rap for Outlet Gutters

Contrary to Specification 2.5, Rip-Rap, rip-rap for outlet gutters will be measured in square metres and payment will be made at the unit price bid for "Rock Rip-Rap - Hand-Laid". This payment will be full compensation for supplying and installing the rip-rap.

4.2.6.5 **Median Fill**

Granular fill material for asphalt concrete or portland cement concrete surfaced medians will be measured in tonnes and payment will be made at the unit price bid for "Granular Fill for Medians".

Earth fill material will be measured and paid for separately at the applicable unit prices bid for the classification of excavation used in accordance with Specification 2.3, Grading.

4.2.6.6 **Median Surfacing**

Median asphalt concrete surfacing will be measured in tonnes and payment will be made at the contract unit price for "Median Asphalt Concrete Surfacing" for the quantity incorporated into the work.

Median portland cement concrete surfacing will be measured in square metres based on the width excluding the curbs and will be paid for at the unit price per square metre for "Median Concrete Surfacing". Separate payment will be made for the curb or curb and gutter section forming the perimeter of the median.

Median topsoiling will be measured and paid for as specified in Specification 2.6, Topsoil Placement.

4.2.6.7 **Backfilling**

No separate payment will be made for backfilling behind structures. The cost of this work will be included in the contract unit price for the particular structure involved.

4.2.6.8 **Supply of Aggregate**

Payment for the supply of aggregate for median fill and median surfacing will be made in accordance with Specification 5.2, Supply of Aggregate.